

UTRICULARIA BREMII (LENTIBULARIACEAE) IN POLAND

ŁUKASZ KRAJEWSKI¹ & BARTOSZ J. PŁACHNO

Abstract. *Utricularia bremii* Heer ex K  lliker has been found in a former sand quarry in D  browa G  rnicza (Silesia-Cracow Upland, S Poland). This subatlantic species is very rarely reported from Western and Southern Europe, and extremely rarely from Central Europe. Some localities were reported from Poland, mainly in the first half of the 20th century, but none of them are considered reliable and the species is not included in the flora of Poland. In the newly discovered locality the species forms a very abundant population in shallow, nutrient-poor ditches and pools. The origin of the population is uncertain, but before sand exploitation started the area was covered by extensive fens.

Key words: distribution, ecology, Lentibulariaceae, Poland, *Utricularia bremii*

Łukasz Krajewski, Department of Nature Protection and Rural Landscape, Institute of Technology and Life Sciences, Falenty, Hrab ska 3, 05-090 Raszyn, Poland; e-mail: lukkrajewski@wp.pl

Bartosz J. Plachno, Department of Plant Cytology and Embryology, Jagiellonian University, Gronostajowa 9, 30-387 Krak  w, Poland; e-mail: bartosz.plachno@uj.edu.pl

INTRODUCTION

The genus *Utricularia* L. is represented by 214 species (Taylor 1989). Five species have been documented from Poland so far: *U. minor* L., *U. intermedia* Hayne, *U. ochroleuca* R. W. Hartm., *U. vulgaris* L. and *U. australis* R. Br. (Mirek *et al.* 2002). *Utricularia bremii* Heer ex K  lliker was excluded as ‘not occurring in Poland’ (Żukowski 1974; Mirek *et al.* 2002).

Utricularia bremii was described by Heer from Katzenssee Lake near Zurich on the basis of specimens collected by Jacob Bremi on June 26, 1836 (Heer in K  lliker 1839), and its presence at the *locus classicus* was confirmed at the end of the 20th century (K  sermann & Moser 1999). *Utricularia bremii* is a very rare species, reported from scattered localities in Central and Western Europe: Belgium, France, Switzerland, Italy, Germany, Denmark, the Czech Republic, Slovakia, Hungary, Romania and Ukraine (Taylor 1989; Beretta & Tassara 2010; Vydrov   *et al.* 2009; Beretta *et al.* 2011; D  t   *et al.* 2013). Because the vegetative shoots of *U. bremii* are morphologically similar to the closely related *U. minor* (of

which it was considered a subspecies or variety for a time), the two species have often been confused (Taylor 1989). Additionally, many historical records of *U. bremii* seem to be erroneous. Thus, the distribution and abundance of *U. bremii* are still not sufficiently recognized. For example, in the Czech Republic it was considered probably extinct but was recently rediscovered and is known from four localities (Vydrov   *et al.* 2009; Adamec pers. comm. 2011).

Utricularia bremii has been reported from several localities in Poland: a few in Upper Lusatia – Luba   (‘Lauban’), J  drzychowice (‘Hennersdorf’), Miku  owa (‘Nikolausdorf’) (Schube 1903, 1904) and Czerna (‘Tschirnewiese’) near W  gliniec (‘Kohlfurt’) (Barber 1893); in the Lublin region in the Pojezierze L  czy  nsko-W  odawskie lake district, without a precise location (Fija  kowski 1960); in Pomerania at Chi  skie Lake near Chojnice (  awrynowicz 1965); and in Warmia between Lutry (‘Lautern’) and W  gsty (‘Wangst’) (Lettau 1911). However, the presence of *U. bremii* in the Polish flora has been questioned by Żukowski (1974) because the only existing herbarium specimens labeled as *U. bremii*, from Miku  owa

¹ Corresponding author

(leg. C. Trautmann 1872, WRSŁ), represented *U. minor*, and none of the remaining historical records have been confirmed. Taylor (1989) did not mention the occurrence of *U. breinii* in Poland in his monograph of the genus *Utricularia*, and the species was not included in the Polish flora (Mirek *et al.* 2002).

In 2009, during a floristic investigation of the large Kuźnica Warężyńska sand quarry in Dąbrowa Górnicza, *U. breinii* was found in shallow pools and ditches by the first author.

MATERIAL AND METHODS

Utricularia breinii was found in an extensive (ca 10 km²) disused sand quarry in Dąbrowa Górnicza city in the central part of the Silesia-Cracow Upland (S Poland). The quarry is a vast, deep pit in which there is a lake having a surface area of ca 5 km². Field observations were made in 2009–2012. To describe the environmental characteristics of *U. breinii*, phytosociological relevés were made on standard plots covering 1 m² each, and 33 of them were chosen for statistical analysis. Nomenclature follows Matuszkiewicz (2007) for syntaxa and mainly Mirek *et al.* (2002) for taxa.

Flowering shoots of *U. breinii* were collected and the flowers were fixed in 70% ethanol and later used for morphological analysis. The pollen grains were analyzed using light and scanning electron microscopy (HITACHI S-4700 SEM in the Scanning Microscopy Laboratory of Biological and Geological Sciences, Jagiellonian University, Kraków) at 20 kV. Voucher specimens are deposited in the herbarium of the Jagiellonian University (KRA). For comparison, additional fresh flowering material of *U. minor* was collected from the Jeleniak-Mikuliny Nature Reserve near the town of Lubliniec. Flowering plants of *U. breinii* from the Czech Republic, kindly lent by Dr. Lubomir Adamec, were used for comparison with the Polish material.

RESULTS AND DISCUSSION

Utricularia breinii Heer ex Kolliker

Figs 1 & 2

Verz. Phan. Gew. Zürich: 142. 1839, and in Hegetschweiler, Fl. Schweiz: 384. 1840. – *U. minor* var. *breinii* (Heer) Franchet, Fl. Loir-et-Cher: 459. 1885. – *U. minor* subsp. *breinii* (Heer) Bertsch & F. Bertsch, Fl. Württemberg & Hohenzollern 386. 1948.

Morphologically, *U. breinii* is most similar to *U. minor*. The following features help distinguish these two species: shape of the lower lip of the flower, pollen grain morphology, and viable seeds.

Utricularia breinii (Fig. 1a–d) has an almost circular lower lip of the flower (sometimes wider than long), with lateral margins that are not bent down (Fig. 1a–c & e). *Utricularia minor* has flowers with a lower lip longer than wide, with margins bent down (Fig. 1f). Most pollen grains produced by *U. breinii* are asymmetric and malformed (Fig. 1d), in contrast to *U. minor* which produces regular grains (for details see Beretta *et al.* 2014).

Utricularia breinii differs from *U. minor* in production of fruits. According to Casper and Manitz (1975), *U. breinii* is probably a male-sterile species. They observed the formation of micronuclei, micropollen, polyads and abortion of pollen. Likewise, Taylor (1989) did not record development of seeds in *U. breinii*, in agreement with our results. It was hypothesized that *U. breinii* might be a hybrid taxon (probable parents: *U. minor*, *U. intermedia*) but this should be confirmed using molecular techniques, as was done for *U. australis* (Kameyama *et al.* 2005). *Utricularia australis* is a sterile plant in Europe, not producing viable pollen grains and seeds. In contrast, microsporogenesis and pollen development typically occur in *U. minor* (Casper & Manitz 1975) and this species produces seeds (Taylor 1989). However, there are two published records of fertile, seed-producing *U. breinii* (Rahmann *et al.* 2001; Adamec 2002). The specimens collected in Poland are identical with *U. breinii* from the Czech Republic, and their morphology fully corresponds with descriptions of the species by Taylor (1989) and Heer (in Kolliker 1839).

SPECIMENS EXAMINED: POLAND, SILESIA-CRACOW UPLAND, Dąbrowa Górnicza, Kuźnica Warężyńska sand quarry, shallow ditch connected with excavation lake, 50°22'37"N, 19°12'51"E, 264 m a.s.l.; ditch adjacent to steep sand quarry margin, 50°23'45"N, 19°13'27"E, 274 m a.s.l., 19 Sept. 2011, leg. Ł. Krajewski (KRA, dried flowering specimens and flowers in alcohol).

HABITAT. The species occurs in nutrient-poor (oligo-, mesotrophic), fully insolated areas with

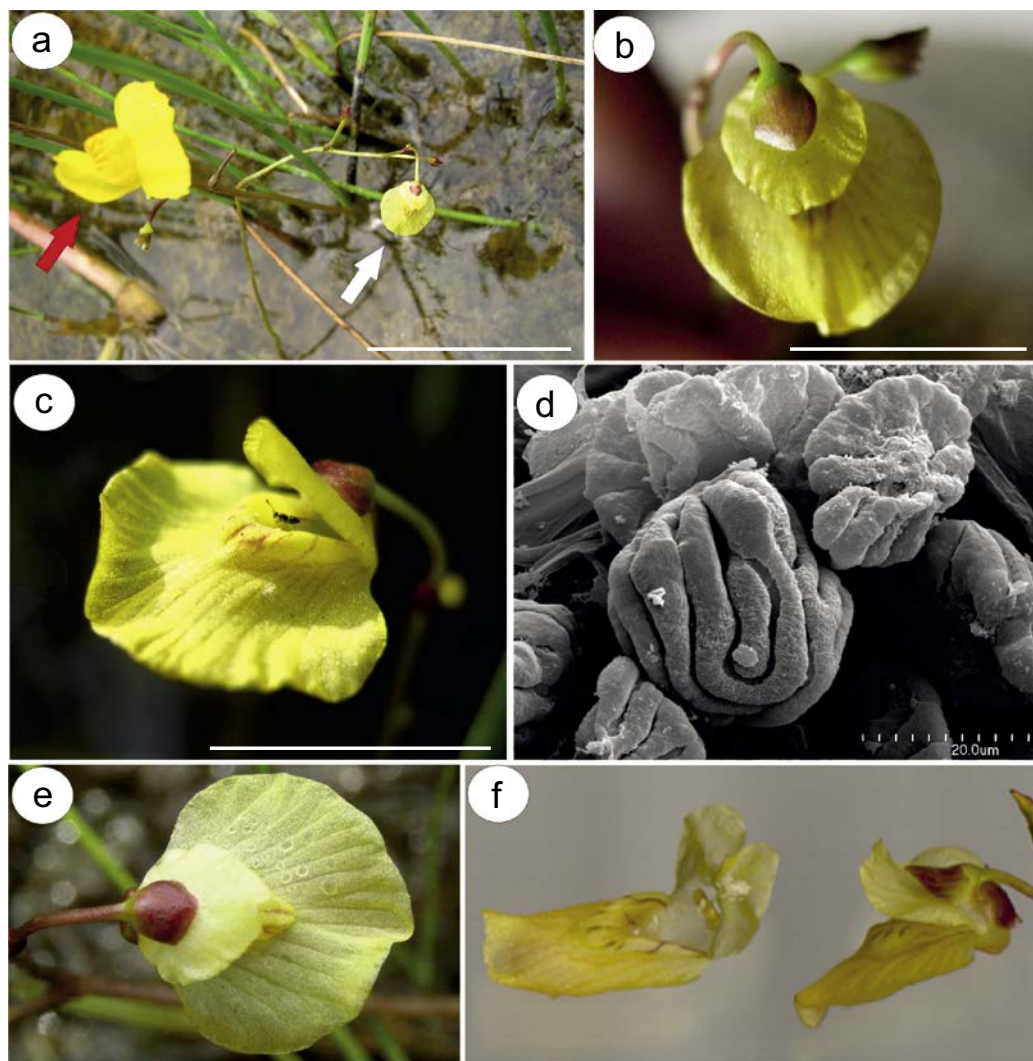


Fig. 1. a – *Utricularia bremsii* Heer ex K  lliker (white arrow) and *U. australis* R. Br. (red arrow) in the Ku  znica War  czy  nska sand quarry in D  browa G  rnicza. b & c – Close-up of flowers of *U. bremsii* from Ku  znica War  czy  nska sand quarry (note almost circular flat lower lip). d – SEM micrograph of *Utricularia bremsii* pollen grains. e – Flower of *U. bremsii* from the Czech Republic. f – Flower of *Utricularia minor* L. with characteristic lateral margins of the lower lip curved downwards. Scale bars: a – 5 cm; b & c – 1 cm. Photo:   . Krajewski (a–c), B. J. P  lachno (d) and L. Adamec (e & f).

scattered vegetation. *Utricularia bremsii* occurs at the bottom of the sand quarry in small water bodies (pools, ditches) fed by ferruginous groundwater. *Utricularia bremsii* occurs abundantly, forming a population estimated at tens of thousands of shoots. It forms its own synusial aggregations in some places. Accompanying species represent several classes of vegetation:

Littorelletea uniflorae, *Iso  to-Nanojuncetea*, *Scheuchzerio-Caricetea nigrae*, *Charetea*, *Potamoetea* and *Phragmitetea*. However, three vegetation types were distinguished. The first group comprises shallow water bodies with *Potamogeton gramineus*, scattered *Phragmites australis*, *Juncus bulbosus* and *Carex echinata*. The second is a group of more species-rich patches

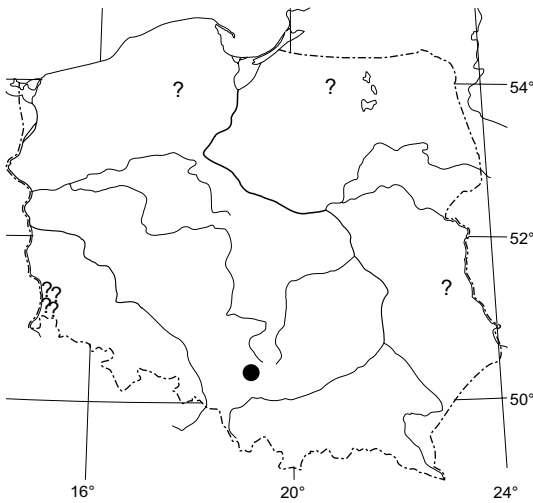


Fig. 2. Distribution of *Utricularia bremii* Heer ex Kölliker in Poland; ● – new locality, ? – doubtful locality from literature.

differentiated by common hydrophytes frequently found in eutrophic waters: *Myriophyllum verticillatum*, *Potamogeton natans*, *Sparganium erectum*, *Lemna minor* and *Equisetum fluviatile*. The third group is characterized by the presence of plants typical for mires and wet mineral sites (*Drosera rotundifolia*, *Lycopodiella inundata*, *Carex viridula*, *Sphagnum fimbriatum*). *Utricularia bremii* prefers periodically inundated, mineral-enriched sites, most often with very shallow water and an organic-mineral bottom. The following species have the highest constancy in phytosociological relevés with *U. bremii*: *Phragmites australis* (V), *Salix rosmarinifolia* (III), *Juncus articulatus* (II), *J. bulbosus* (II), *J. effusus* (II), *Myriophyllum verticillatum* (II) and *Typha latifolia* (II). In July 2011, *U. bremii* blossomed in trenches dug a year before near a stand of *Cladium mariscus* (sterile *Utricularia minor* recorded in phytosociological relevé of *Cladietum marisci* on June 28, 2009 (Krajewski 2011) in fact was *U. bremii*). In 2012, numerous *U. bremii* were also observed in shallow water of a large excavation lake in the Kuźnica Warężyńska sand quarry, called Pogoria IV (Fig. 1a). Among the scattered helophytes, *U. bremii* grew to 0.5 m water depth, together with *Nitella syncarpa* (Krajewski 2012), a rare subatlantic species endemic to Europe.

Utricularia bremii is a rare plant in the European flora, and a species with low competitive ability. It has disappeared from numerous historical locations due to extensive drainage of mires and increasing eutrophication. For example, it has completely disappeared from the Ukraine, where it was known from only a single record in Transcarpathia (Kish & Danilik 2009). Hence it has been red-listed in Europe (Bilz *et al.* 2011).

The locality of *U. bremii* in Dąbrowa Górnicza is formally protected within the Nature 2000 Special Area of Conservation called Lipienniki w Dąbrowie Górniczej ('Fen Orchids in Dąbrowa Górnicza'). However, drainage is being done there, part of the area has recently been sold to a private investor despite the legal protection status, and the conservation perspectives for *U. bremii* are unfavorable.

It has been suggested that *U. bremii* and *U. minor* have similar ecological requirements (Moravec 1995), while *U. minor* and *U. australis* grow mainly in more alkaline and mineral-rich habitats than *U. ochroleuca* and *U. intermedia* (Kosiba 2004; Dítě *et al.* 2006). Both in the Czech Republic and Dąbrowa Górnicza, *U. bremii* grows together with *U. australis*. The second species is ecologically very plastic and can grow in various types of artificial water reservoirs (Płachno 2008).

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REFERENCES

- ADAMEC L. 2002. News and views. *Carnivorous Plant Newsletter* **31**: 19.
- BARBER E. 1893. Die Flora der Görlitzer Heide. *Abhandlungen der Naturforschenden Gesellschaft zu Görlitz* **20**: 57–146.
- BERETTA M. & TASSARA F. 2010. *Utricularia bremii* Heer ex Kölliker. *Inform. Bot. Ital.* **42**(2): 589–591.
- BERETTA M., RODONDI G., ADAMEC L. & ANDREIS C. 2014. Pollen morphology of European bladderworts (*Utricularia* L., Lentibulariaceae) *Rev. Palaeobot. Palynol.* **205**: 22–30.
- BERETTA M., SIMONAZZI M., ARRIGONI P. & TASSARA F. 2011. New sites of *Utricularia bremii* Heer ex Kölliker (Lentibulariaceae): considerations on its distribution and conservation in Italy. *Inform. Bot. Ital.* **43**(1): 91–95 (in Italian with English summary).
- BILZ M., KELL S. P., MAXTED N. & LANSDOWN V. 2011. European Red List of Vascular Plants. Publication Office of the European Union, Luxembourg.
- CASPER S. J. & MANITZ H. 1975. Beiträge zur Taxonomie und Chorologie der mitteleuropäischen *Utricularia*-Arten. 2. Androsporangien, Chromosomen-zahlen und Pollenmorphologie. *Feddes Repert.* **86**(4): 211–232.
- DÍTĚ D., HRIVNÁK R. & ELIÁŠ P. JUN. 2013. *Utricularia bremii* (Lentibulariaceae) rediscovered in Slovakia. *Polish Bot. J.* **58**(2): 653–658.
- DÍTĚ D., NAVRÁTILOVÁ J., HÁJEK M., VALACHOVIČ M. & PUKAJOVÁ D. 2006. Habitat variability and classification of *Utricularia* communities: Comparison of peat depressions in Slovakia and the Trebon basin. *Preslia* **78**: 331–343.
- FIAŁKOWSKI D. 1960. The flora of Łęczna-Włodawa Lake District and adjacent peat bogs. *Ann. Univ. Mariae Curie-Skłodowska, Sect. B* **14**(3): 131–206 (in Polish with English summary).
- KAMEYAMA Y., TOYAMA M. & OHARA M. 2005. Hybrid origins and F1 dominance in the free-floating sterile bladderwort, *Utricularia australis* f. *australis* (Lentibulariaceae). *Amer. J. Bot.* **92**: 469–476.
- KÄSERMANN C. & MOSER D. M. 1999. Fiches pratiques pour la conservation – Plantes à fleurs et fougères. OFEFP, Bern.
- KISH R. YA. & DANILIK I. M. 2009. Pukharnik brema *Utricularia bremii* Heer (*U. minor* L. subsp. *bremii* (Heer) Nyman). In: YA. P. DIDUKH (ed.), *Chervona Kniga Ukraini*, p. 514. Roslinnij Svit, Kiiv.
- KÖLLIKER A. 1839. Verzeichnis der Phanerogamischen Gewächse des Cantons Zürich. Druck von Orell, Füssli & Co., Zürich.
- KOSIBA P. 2004. Chemical properties and similarity of habitats of *Utricularia* species in Lower Silesia, Poland. *Acta Soc. Bot. Poloniae* **73**(4): 335–341.
- KRAJEWSKI Ł. 2011. *Cladietum marisci* association in Dąbrowa Górnicza sand pit against background of Great Fen-sedge *Cladium mariscus* occurrence in Poland. *Chrońmy Przyr. Ojczystą* **67**(3): 276–283 (in Polish with English summary).
- KRAJEWSKI Ł. 2012. Stoneworts (Characeae) of Zagłębie Dąbrowskie (S Poland). *Natura Silesiae Superioris* **13**: 13–56 (in Polish with English and German summaries).
- LAWRYNOWICZ J. 1965. Lobelia lakes in East and North-Eastern part of Chojnice County. *Badan. Fizjogr. Polsk. Zachodn., B* **16**: 195–198 (in Polish).
- LETTAU A. 1911. Floristische Untersuchungen im Kreise Rössel und in Teilen angrenzender kreise in Sommer 1910. *Jahresbericht des Preußischen Botanischen Vereins* [1910]: 17–25.
- MATUSZKIEWICZ W. 2007. Przewodnik do oznaczania zbiorowisk roślinnych Polski. Vademecum Geobotanicum 3. Wydawnictwo Naukowe PWN, Warszawa.
- MIREK Z., PIĘKOŚ-MIRKOWA H., ZAJĄC A. & ZAJĄC M. 2002. Flowering plants and pteridophytes of Poland. A checklist. Polish Academy of Sciences, W. Szafer Institute of Botany, Kraków.
- MORAVEC J. 1995. Red list of plant communities of the Czech Republic and their endangerment. Ed. 2. *Severočes. Přír. Suppl.*: 1–206 (in Czech with English summary).
- PŁACHNO B. J. 2008. *Utricularia australis* – species rare or common in Upper Silesia? *Przyroda Górnego Śląska* **54**: 12–13 (in Polish).
- RAHMANN O. U., ADAMEC L. & KATSUHIKO K. 2001. Chromosome numbers of *Utricularia bremii* and *Utricularia dimorphanta* (Lentibulariaceae). *Chromosome Science* **5**: 105–108.
- SCHUBE T. 1903. Die Verbreitung der Gefäßpflanzen in Schlesien preußischen und österreichischen Anteils. Druck von R. Nischkowsky, Breslau.
- SCHUBE T. 1904. Flora von Schlesien preußischen und österreichischen Anteils. Verlag von Wilh. Gottl. Korn, Breslau.
- TAYLOR P. 1989. The genus *Utricularia* – a taxonomic monograph. *Kew Bull., Addit. Ser.* **14**: 1–734.
- VYDROVÁ A., GRULICH V., EKRT L. & EKRTOVÁ E. 2009. Řídká blana near Zaháji (South Bohemia) – a significant locality of aquatic and marsh flora and vegetation. *Muzeum a Současnost, Roztoky, Seriae Naturae* **24**: 27–54 (in Czech with English summary).
- ŻUKOWSKI W. 1974. Distribution of the species of the genus *Utricularia* L. in Poland. *Badan. Fizjogr. Polsk. Zachodn., B* **27**: 189–217 (in Polish with English summary).